What is claimed is:

1- A ternary solder alloy which is lead free, of high strength and particularly well suited for microelectronic applications consisting essentially of tin, silver and bismuth with tin in a major proportion, bismuth in excess of 5 wt% and up to 25 wt% and silver in a range from about 2 wt % to less than 5% silver.

2- A ternary solder alloy as defined in claim 1 consisting essentially of tin in a range from about 70 wt% to less than 91 wt %, bismuth in a range from about 5 wt% to 25 wt% and silver in a range from 2 wt% to 5 wt%.

3- A ternary solder alloy as defined in claim 2 consisting essentially of about 6.1 wt% bismuth, 3.1 wt% silver balance tin.

4- A ternary solder alloy as defined in claim 2 consisting essentially of about 10-1 5 wt% bismuth, 3.3-3.5 wt% silver, balance tin and having a controlled liquidus temperature of between about 191 °C -201 °C.

5- A microelectronic structure comprising at least two microelectronic components joined by means of a solder alloy with the solder alloy consisting essentially of tin, silver and bimuth with tin in a major proportion, bismuth in excess of 5 wt% and up to 25 wt% and silver in a range from about 2 wt% to less than 5 wt%.

6- A microelectronic structure as defined in claim 5 wherein said solder alloy consists essentially of from about 70 to less than 91 weight percent tin, from about 5 wt% to 25 wt% bismuth and from 2 wt% to 5 wt% silver.

7- A microelectronic structure as defined in claim 5 wherein said microelectronic components are selected from the group consisting of: chip carriers, IC chips and circuit boards.

8- A method of joining at least two microelectronic components to one another comprising the steps of connecting the components to be joined with a ternary solder alloy consisting essentially of a major proportion of tin, between about 5 to 25 wt% bismuth and 2 to 5 wt% silver.

9- A method as defined in claim 8 wherein said solder alloy consists essentially of from about 70 to less than 91 weight percent tin, from about 5 to 25 wt% bismuth and from 2 to.5 wt% silver.

10- A method as defined in claim 8 wherein said solder alloy consists essentially of about 10-1 5 wt% bismuth, 3.3-3.5 wt% silver, balance tin .

11- A solder paste comprising a flux, an organic vehicle and particles of metal having a composition consisting essentially of a major proportion by weight of tin, between about 5 to 25 wt% bismuth and from 2 to 5 wt% silver.

12- A solder paste as defined in claim 11 wherein said composition consists essentially of from about 70 to less than 91 weight percent tin, from about 5 to 25 wt% bismuth and from 2 to 5 wt% silver.

13- A process for producing circuit boards, comprising the steps of:

producing plated through holes in a circuit board;

inserting the pins of pin-in-hole components into the plated through holes;

producing a stationary wave of liquid solder consisting essentially of a major proportion of tin, between about 5 to 25 wt% bismuth and from 2 to 5 wt% silver;

moving the circuit board across the wave with the bottom of the circuit board in contact with the wave, thereby substantially filling the plated through holes with solder; and

cooling the circuit board to form solid solder joints.

14- A process for producing circuit boards comprising the steps of:

producing a substrate with multiple wiring layers including exposed metal pads on a surface;

forming a solder paste comprising a flux, an organic vehicle and particles of metal consisting essentially of a major proportion of tin, bismuth in excess of 5 wt% and up to 25 wt% and from 2 to 5 wt% silver;

depositing the solder paste upon said substrate;

placing terminals of a surface mount component onto corresponding pads of the substrate;

heating said solder paste to a temperature sufficient to reflow the solder paste to conned the component with the substrate; and

cooling to solidify the connections.